Detection of Pericardial Metastases by Cross-sectional Echocardiography

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SUMMARY Cross-sectional echocardiography was performed on 69 patients with pericardial effusion. The etiology of the pericardial effusion was malignant infiltration of the pericardium in nine patients; chronic renal failure in 10; postcardiac surgery in 31; viral pericarditis in three; tuberculous pericarditis in two; and undetermined in 14. Seven of the nine patients with pericardial metastases were noted to have irregular cauliflower-like masses protruding from the pericardium and the epicardium into the echo-free space of the pericardial effusion. These masses demonstrated a to-and-fro motion within the pericardial space during ventricular systole. The presence of pericardial metastases was confirmed at operation in four cases, and the three others had intrathoracic or colonic malignancy with widespread metastases. None of the patients without pericardial metastases showed the characteristic abnormality seen in patients with pericardial metastases. Six patients had dense linear echoes connecting the pericardium and epicardium that probably represented adhesions (confirmation at surgery in one, and confirmation at autopsy in another), with an appearance that was different from that seen in pericardial metastases. We conclude that cross-sectional echocardiography may be useful for detecting pericardial metastases.

ECHOCARDIOGRAPHY is a sensitive method of diagnosing pericardial effusion.1-8 Pericardial effusion in a patient with systemic malignancy raises the suspicion of pericardial metastases. A noninvasive technique that could further support the diagnosis of metastatic involvement of the pericardium is clinically important. In this paper we describe the cross-sectional echocardiographic findings in nine patients with malignant infiltration of the pericardium.

Materials and Methods Cross-sectional echocardiography was performed on 69 patients with pericardial effusion detected by M-mode echocardiography. The etiology of the pericardial effusion was chronic renal failure in 10 patients; post–cardiac surgery in 31; viral in three; tuberculous in two; and uncertain in 14. Nine patients had an associated systemic malignancy. Six patients had carcinoma of the lung; two had carcinoma of the colon with metastases to the lung; and another had carcinoma of the esophagus with metastases. The patients were in the 30° left lateral decubitus position during the examination. A commercially available wide-angle, phased-array sector scanner or a mechanical sector scanner was used. The long-axis, short-axis and apical four-chamber views were used to assess the pericardial space.

Results A pericardial effusion on the cross-sectional echocardiogram appears as an echo-free space between the epicardium and the pericardium (fig. 1). However, the sensitivity of cross-sectional echocardiography is detecting pericardial effusion has not been systematically evaluated. In 13 patients, abnormal dense echoes within the pericardial sac that persisted despite optimal gain setting were present. Seven patients (group 1) had associated systemic malignancy. In four of these patients the presence of pericardial metastases was confirmed at the time of thoracotomy for creation of a pericardial window, and the thoracotomy data corresponded anatomically to the echocardiographic findings in three patients; in the fourth patient the thoracotomy report did not specify the exact site of the metastases, so comparison with echo data was not possible. The three others had either carcinoma of the lung (two patients) or carcinoma of the colon (one patient), with widespread metastases. The abnormal echoes consisted of cauliflower-like masses that protruded into the pericardial sac and they demonstrated a to-and-fro oscillatory movement during the cardiac cycle. Six other patients had abnormal echoes within the pericardial sac. Four had undergone open heart surgery within 3 weeks of the echocardiogram and two had chronic renal failure. The abnormality consisted of dense linear echoes which extended from the pericardium to the epicardium, with resultant motion of the pericardium. The presence of adhesions was confirmed at operation in one patient and at autopsy in another.

The cross-sectional echocardiogram of a patient with pericardial metastases proved at surgery is illustrated in figure 2. A pericardial effusion is seen, and multiple abnormal dense echoes protrude into the pericardial space from the parietal pericardium and the visceral pericardium (epicardium). The ultrasound
FIGURE 1. Cross-sectional echocardiogram in the long-axis view showing a large pericardial effusion (PE). The pericardial space is clear, and no abnormal echoes are seen within the pericardial sac. LV = left ventricular cavity.

FIGURE 2. Cross-sectional echocardiogram in the long-axis view in a patient with surgically proved pericardial metastases. A pericardial effusion (PE) is present. Note the abnormal echoes (M) that project into the pericardial space from the pericardium (P) and the epicardium. These echoes demonstrated a to-and-fro oscillatory motion during the cardiac cycle, and they probably represent pericardial metastases. LV = left ventricular cavity; LVW = left ventricular wall.

FIGURE 3. Cross-sectional echocardiogram in the long-axis view in a patient with surgically proved pericardial metastases. A large, irregular mass (T) is seen to protrude into the pericardial effusion (PE). The mass probably represents pericardial metastases. LVW = left ventricular wall.

FIGURE 4. Cross-sectional echocardiogram in the long-axis view illustrating a pericardial effusion (PE) with irregular masses (m) protruding into the pericardial sac. These masses demonstrated marked oscillations during the cardiac cycle, and probably represent metastases. LV = left ventricular cavity.

record of a patient with surgically proved pericardial metastases is shown in figure 3. An irregular, cauliflower-like mass is seen to protrude into the pericardial space. Another example of pericardial metastases is shown in figure 4. The cross-sectional echocardiogram of a patient with chronic renal failure is shown in figure 5. A dense linear echo traverses the pericardial space and connects the epicardium to the pericardium. At autopsy, this patient was noted to have fibrous adhesions within the pericardial sac.

Discussion
Pericardial effusion can be readily diagnosed by M-mode and cross-sectional echocardiography. We
observed abnormal echoes within the pericardial space in 13 of our subjects. Patients with proved or probable pericardial metastases (group 1) had cauliflower-like masses protruding from the parietal and visceral (epicardium) pericardial surfaces into the pericardial space. Portions of these masses demonstrated an oscillatory motion during the cardiac cycle. In contrast, group 2 patients were noted to have dense linear echoes extending from the epicardium to the pericardium, with resultant motion of the pericardium during systole. These echoes probably represented adhesions; this was confirmed at operation in one patient and at autopsy in another. Although the cross-sectional echocardiographic characteristics of group 1 and group 2 patients appeared to be different, in the atypical case ultrasound differentiation between the two groups may not be possible. Furthermore, pericardial metastases and pericardial adhesions may coexist in the same patient.

Of the seven patients with pericardial metastases and abnormal echoes in the pericardial sac, the interpreter of the echocardiogram was aware that the patient had systemic malignancy in three patients, while in the four others, the echocardiographer did not know that the patient under review was suffering from a systemic malignancy. Thus, in the latter four patients, the abnormality on the echocardiogram raised the suspicion of pericardial metastases. Therefore, cross-sectional echocardiography could prove to be useful for diagnosing pericardial metastases.

In summary, abnormal echoes within the pericardial sac were noted on the cross-sectional echocardiogram in seven of nine patients with malignant pericardial effusion. Because so few patients were studied, a realistic estimate of the sensitivity and specificity of this abnormality for pericardial metastases cannot be obtained; further investigation to answer these questions is indicated. Although the echocardiographic appearance of intrapericardial echoes in patients with chronic renal failure and in those who have had recent open heart surgery is different from the abnormality in malignant pericardial effusion, the former subset of patients may pose a problem in differential diagnosis.

References

Detection of pericardial metastases by cross-section echocardiography.

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